Geophysical Research Abstracts
Vol. 12, EGU2010-4472, 2010
EGU General Assembly 2010

Large-scale stirring in the southern stratospheric polar vortex during the final warming of 2005

Alvaro de la Camara (1,2), Carlos R. Mechoso (2), Kayo Ide (2,3), Richard Walterscheid (4), and Gerard Schubert (5)

(1) Universidad Complutense de Madrid, Dep. Geofisica y Meteorologia, Madrid, Spain (alvarocamara@fis.ucm.es, 0034 913944398), (2) University of California Los Angeles, Dep. Atmospheric and Oceanic Sciences, Los Angeles, USA, (3) University of Maryland, Dep. Atmospheric and Oceanic Sciences, College Park, USA, (4) The Aerospace Corporation, Space Sciences Dep., Los Angeles, USA, (5) Institute of Geophysics and Planetary Physics, University of California Los Angeles, Dep. Earth and Space Sciences, Los Angeles, USA

The present work examines the large-scale stirring during the final warming of the Southern Hemisphere stratosphere in the spring of 2005. A unique set of in situ observations collected by 27 superpressure balloons (SPBs) is used. The balloons, which were launched from McMurdo, Antarctica, by the Stratéole/VORCORE project, drifted for several weeks o tow different isopycnic levels in the lower stratosphere. To gain insight on the mechanisms responsible for the horizontal transport of air inside and outside the well-isolated vortex we examine the balloon trajectories in the framework of Lagrangian properties of the stratospheric flow. An approximation to coherent structures of the flow are visualized by computing finite-time Lyapunov exponents (FTLE). A combination of isentropic analysis and distributions of FTLE maxima reveals that air is stripped away from the vortex's interior as stable manifolds eventually cross the vortex's edge. It is shown that two SPBs escaped from the vortex within high potential vorticity tongues that developed in association with wave breaking at locations along the vortex's edge where forward and backward FTLE maxima approximately intersect. The trajectories of three SPBs flying as a group at the same isopycnic surface are examined and their behavior is interpreted in reference to the FTLE field. These results support the concept of stable and unstable manifolds governing transport of air masses across the periphery of the stratospheric polar vortex.